1. What are the *possible Integer* roots of the polynomial below?

$$f(x) = 6x^3 + 4x^2 + 3x + 3$$

A. All combinations of: $\dfrac{\pm 1, \pm 2, \pm 3, \pm 6}{\pm 1, \pm 3}$

B. $\pm 1, \pm 2, \pm 3, \pm 6$

C. $\pm 1, \pm 3$

D. All combinations of: $\dfrac{\pm 1, \pm 3}{\pm 1, \pm 2, \pm 3, \pm 6}$

E. There is no formula or theorem that tells us all possible Integer roots.

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2. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{15x^3 - 38x^2 + 34}{x - 2}$$

A. $a \in [27, 31], b \in [21, 25], c \in [41, 48]$, and $r \in [122, 126]$.

B. $a \in [27, 31], b \in [-100, -94], c \in [196, 202]$, and $r \in [-362, -355]$.

C. $a \in [13, 19], b \in [-8, -7], c \in [-18, -15]$, and $r \in [0, 8]$.

D. $a \in [13, 19], b \in [-72, -66], c \in [135, 142]$, and $r \in [-244, -232]$.

E. $a \in [13, 19], b \in [-23, -20], c \in [-27, -20]$, and $r \in [10, 15]$.

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3. Factor the polynomial below completely, knowing that $x - 5$ is a factor. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3 \leq z_4$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 12x^4 - 1x^3 - 266x^2 - 205x + 300$$

A. $z_1 \in [-4.9, -3.1]$, $z_2 \in [-1.79, -1.55]$, $z_3 \in [0.73, 0.83]$, and $z_4 \in [4.82, 5.32]$

B. $z_1 \in [-5.2, -4.6]$, $z_2 \in [-1.39, -1.31]$, $z_3 \in [0.52, 0.73]$, and $z_4 \in [3.73, 4.71]$

C. $z_1 \in [-5.2, -4.6]$, $z_2 \in [-0.91, -0.61]$, $z_3 \in [1.58, 1.83]$, and $z_4 \in [3.73, 4.71]$

D. $z_1 \in [-4.9, -3.1]$, $z_2 \in [-0.71, -0.54]$, $z_3 \in [1.24, 1.38]$, and $z_4 \in [4.82, 5.32]$

E. $z_1 \in [-5.2, -4.6]$, $z_2 \in [-3.17, -2.81]$, $z_3 \in [0.4, 0.57]$, and $z_4 \in [3.73, 4.71]$

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4. Factor the polynomial below completely. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 25x^3 - 50x^2 - 69x - 18$$

A. $z_1 \in [-3.9, -2.8]$, $z_2 \in [-0.07, 0.38]$, and $z_3 \in [2.7, 4.2]$

B. $z_1 \in [-2.6, -1.3]$, $z_2 \in [-1.75, -1.59]$, and $z_3 \in [2.7, 4.2]$

C. $z_1 \in [-3.9, -2.8]$, $z_2 \in [0.23, 0.59]$, and $z_3 \in [-0.3, 1.1]$

D. $z_1 \in [-3.9, -2.8]$, $z_2 \in [1.62, 1.74]$, and $z_3 \in [2.3, 2.9]$

E. $z_1 \in [-1.6, 0.1]$, $z_2 \in [-0.46, -0.26]$, and $z_3 \in [2.7, 4.2]$

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5. Factor the polynomial below completely. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 12x^3 - 77x^2 + 131x - 60$$

A. $z_1 \in [0.63, 0.78]$, $z_2 \in [1.57, 1.81]$, and $z_3 \in [4, 4.07]$

B. $z_1 \in [0.6, 0.71]$, $z_2 \in [1.23, 1.4]$, and $z_3 \in [4, 4.07]$

C. $z_1 \in [-4.1, -3.95]$, $z_2 \in [-1.92, -1.56]$, and $z_3 \in [-0.81, -0.65]$

D. $z_1 \in [-5.12, -4.95]$, $z_2 \in [-4.14, -3.6]$, and $z_3 \in [-0.28, -0.19]$

E. $z_1 \in [-4.1, -3.95]$, $z_2 \in [-1.56, -1.04]$, and $z_3 \in [-0.74, -0.46]$

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6. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{16x^3 - 24x^2 - 31x + 35}{x - 2}$$

A. $a \in [30, 39], \; b \in [-89, -86], \; c \in [145, 149], \text{ and } r \in [-257, -250].$

B. $a \in [13, 17], \; b \in [1, 9], \; c \in [-15, -11], \text{ and } r \in [2, 13].$

C. $a \in [13, 17], \; b \in [-59, -55], \; c \in [74, 85], \text{ and } r \in [-127, -124].$

D. $a \in [30, 39], \; b \in [39, 43], \; c \in [46, 50], \text{ and } r \in [127, 135].$

E. $a \in [13, 17], \; b \in [-11, -7], \; c \in [-43, -34], \text{ and } r \in [-4, 2].$

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7. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{10x^3 - 40x^2 - 10x + 37}{x - 4}$$

A. $a \in [7, 13], \; b \in [-2, 7], \; c \in [-10, -6], \text{ and } r \in [-5, 0].$

B. $a \in [7, 13], \; b \in [-11, -3], \; c \in [-42, -38], \text{ and } r \in [-88, -79].$

C. $a \in [35, 44], \; b \in [-201, -193], \; c \in [788, 794], \text{ and } r \in [-3124, -3119].$

D. $a \in [7, 13], \; b \in [-83, -73], \; c \in [306, 313], \text{ and } r \in [-1203, -1196].$

E. $a \in [35, 44], \; b \in [119, 129], \; c \in [464, 476], \text{ and } r \in [1916, 1918].$

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8. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{8x^3 - 62x + 35}{x + 3}$$

A. $a \in [-29, -20], b \in [-76, -71], c \in [-280, -275], \text{ and } r \in [-800, -798].$

B. $a \in [-29, -20], b \in [69, 75], c \in [-280, -275], \text{ and } r \in [869, 873].$

C. $a \in [8, 14], b \in [-35, -31], c \in [66, 67], \text{ and } r \in [-233, -227].$

D. $a \in [8, 14], b \in [22, 30], c \in [9, 22],$ and $r \in [60, 72]$.

E. $a \in [8, 14], b \in [-26, -21], c \in [9, 22],$ and $r \in [4, 8]$.

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9. Factor the polynomial below completely, knowing that $x - 5$ is a factor. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3 \leq z_4$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 15x^4 - 44x^3 - 159x^2 + 8x + 60$$

A. $z_1 \in [-10, -4],\ z_2 \in [-0.26, -0.18], z_3 \in [1.99, 2.03],$ and $z_4 \in [1, 4]$

B. $z_1 \in [-10, -4],\ z_2 \in [-0.66, -0.58], z_3 \in [0.65, 0.68],$ and $z_4 \in [1, 4]$

C. $z_1 \in [-10, -4],\ z_2 \in [-1.68, -1.51], z_3 \in [1.46, 1.52],$ and $z_4 \in [1, 4]$

D. $z_1 \in [-2, 1],\ z_2 \in [-0.73, -0.64], z_3 \in [0.58, 0.61],$ and $z_4 \in [5, 6]$

E. $z_1 \in [-2, 1],\ z_2 \in [-1.52, -1.49], z_3 \in [1.63, 1.71],$ and $z_4 \in [5, 6]$

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10. What are the *possible Rational* roots of the polynomial below?

$$f(x) = 3x^2 + 6x + 7$$

A. $\pm 1, \pm 3$

B. All combinations of: $\dfrac{\pm 1, \pm 3}{\pm 1, \pm 7}$

C. $\pm 1, \pm 7$

D. All combinations of: $\dfrac{\pm 1, \pm 7}{\pm 1, \pm 3}$

E. There is no formula or theorem that tells us all possible Rational roots.
